THE DISRUPTED COMETARY NUCLEUS IMPACT WITH THE MOON. V. V. Shevchenko, Sternberg State Astronomical Institute, Moscow University, Moscow, Russia.

Usually, if a comet falls to the surface of the nearside of the Moon at a low angle, it can be assumed that this small body has previously passed near to the Earth [1]. As a result, the change of a comet trajectory and disintegration of the nucleus into separate fragments happens at the intersection of the tidal limit (the Roche distance). The Roche distance for a body with low density passing near to the Earth can be estimated from the dependences offered in [2] or [3]. For a body with a density of ~0.5 g/cm^3, both expressions give a value of ~5 R_e (where R_e is Earth's radius).

Simulation of the process of disintegration under the effect of the tidal forces of comet Shoemaker-6 Levy 9 [4–6] shows that at the first stage a debris cloud of small-sized fragments (centimeter and meter sizes) is formed. The cloud has the form of a cylinder. Such clouds may have reaccreted into compact objects nearly two years later. In the case of movement of a cometary body in the Earth-Moon system (during less than a one-day period) reaccretion does not occur. Therefore, on the lunar surface a cloud of small-sized fragments falls out. As a result, the observable diffuse structures, including small-sized crater clusters, will be formed.

The following model corresponds to the assumption that the diffuse structures are the result of falling debris clouds of low-density fragments. An example of an observable result of such a fall may be the details of the albedo formation Reiner-gamma on the visible hemisphere of the Moon. A part of the Reiner-gamma diffuse structure with details up to 300–500 m was shown on the fragment of the Lunar Orbiter IV frame H-157.

The common morphological analysis shows the presence of two populations of craters. Craters of later origin have sharp forms, which are underlined by the presence of internal shadows, and overlap albedo features. Craters with flat floors and smooth forms are associated with albedo structures. It is known that similar crater forms arise in cases when the density of the impactor is much lower than the density of the target. It corresponds to the process of a cometary nucleus or its fragments falling onto the lunar surface [7].

The evaluation of the sizes of separate fragments in a debris cloud confirms the reality of such a model. The maximum crater diameter for a population associated with a diffuse structure does not exceed 1 km. For the calculation of the impactor size the dependence from [8] was used. For a velocity value of 10 km/s a maximum impactor diameter reaches about 40 m, which would be the result of the calculation for a model of tidal destruction of a cometary body near a planet [4,5].

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